Additive Manufacturing of Telescope Mirrors, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

This Phase 1 SBIR is to demonstrate feasibility of using selective laser melting (SLM) to produce a 3-meter symmetrical radius of curvature (ROC) isogrid mirror substrate which will significantly reduce traditional mechanical machining of the mirror surface before and after nickel plating. The technique in accomplishing this is by fabricating the lens facesheet as the top most layers in the melting process. This way, our melting technique in producing the best possible finish on the lens surface SLM can provide. If this is successful, then performing a electro-polishing of the substrate before nickel plating the lens facesheet, single point diamond turning (SPDT) is the only time it is necessary. By developing the SLM techniques having a facesheet ROC with minimum variation, and having an optimized facesheet thickness designed for additive manufacturing, this substrate can be scaled to support flight hardware designs for UVOIR mirrors.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: We recognize that NASA, even as leaders in the application of AM across the aerospace industry, is likely to take a conservative approach to adopting flight-rated SLM components. However, we do believe there are several near-term applications. For example, additive manufactured mirrors using the techniques we will develop in Phase 1, can be directly applied to relatively small aperture mirrors which are launch on sounding rockets. Our current capabilities using the Concept Laser M2 are a direct fit for further development of mirror substrates to be used in infrared or ultraviolet or optical applications. A good example is the optical lens associated with missions in the Medium Class Explorers (MIDEX) TESS mission. In addition, continued mirror development and mounting schemes, we can see the development of larger segmented mirror development for launch

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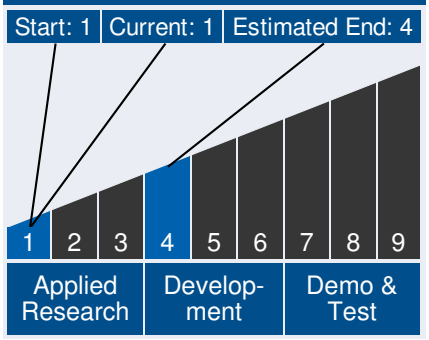
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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on the future Space Launch System.

To the commercial space industry:

Potential Non-NASA Commercial Applications: ASTS plans to develop processes and techniques using SLM on materials such as SS316L, Inconel 718, Ti6Al4V, and copper based materials used for rocket combustion devices. In addition, we see potential in the use of aluminum silicon based alloys, which can be used as a mirror substrate for nickel plating. With this as an option, application for optical in infrared mirrors could be developed as a low cost solution for utilization in unmanned aerial vehicles (UAV) for a variety of functions such as in the agriculture industry for climate and soil moisture monitoring, and in the transportation industry for delivery products or packages to residential addresses. Technological advances in mirror integration have developed in in performance over traditional optical camera lenses. Our development in SLM for mirror substrate fabrication should reduce the cost in mirror fabrication for such applications.

Management Team *(cont.)*

Principal Investigator:

- Robert Harrison

Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ Remote Sensing Instruments and Sensors (TA 8.1)
  └ Optical Components (TA 8.1.3)

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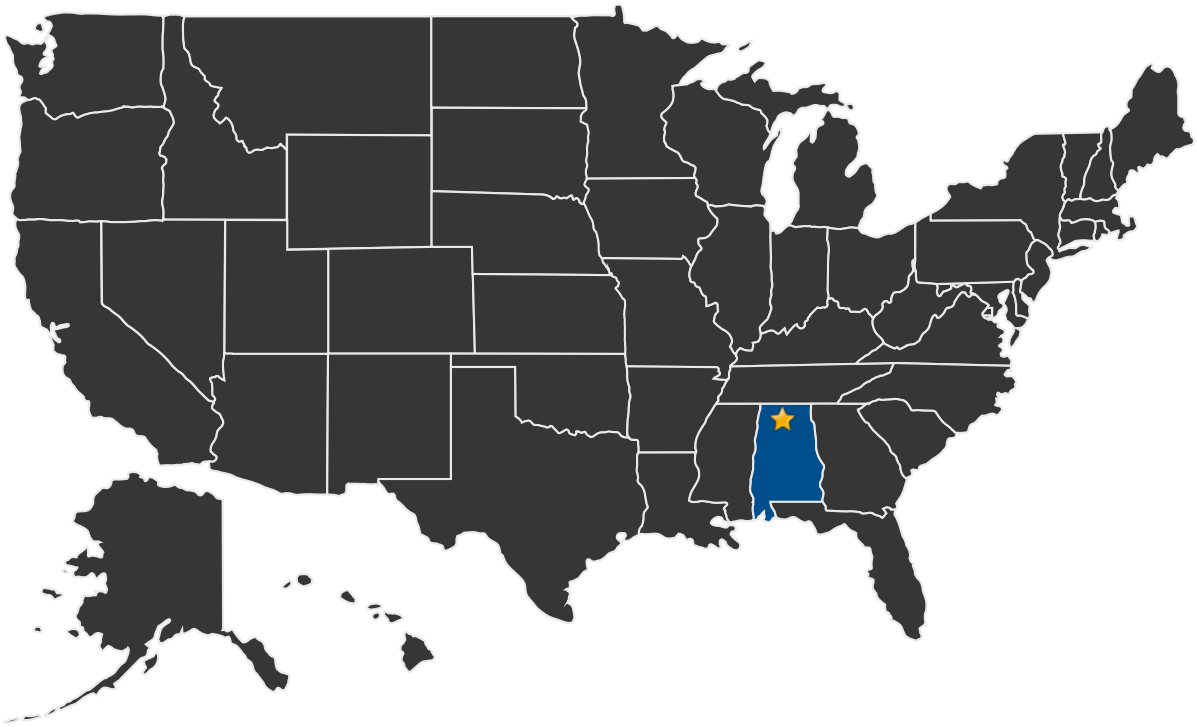
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Marshall Space Flight Center

Other Organizations Performing Work:

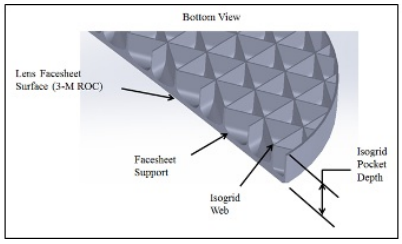
- Arctic Slope Technical Services, Inc. (Huntsville, AL)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23259)

IMAGE GALLERY



Additive Manufacturing of Telescope Mirrors, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

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